

CLAIMS

What is claimed is:

1. A filter unit for an exhaust removing filter system having one or more attachable units for
2 varying the size of the filter system, the filter unit comprising:
3 a housing;
4 a plurality of concentrically arranged particulate filters within the housing;
5 a plurality of first passages passing adjacent at least one particulate filter and
6 opened to a first end of the housing; and
7 a plurality of second passages passing adjacent at least one particulate filter and
8 opened to a second end of the housing;
9 whereby exhaust passes through one of the particulate filters as the exhaust moves
10 from the first passages to the second passages.
- 11.2. The filter unit of claim 1, wherein the housing includes an outer shell and an inner shell.
- 12.3. The filter unit of claim 2, wherein the inner shell is concentrically positioned within an
13 innermost particulate filter.
- 14.4. The filter unit of claim 2, further comprising a third passage extending between one of an
15 outermost particulate filter and the outer shell, and a fourth passage extending between
16 an innermost particulate filter and the inner shell.

1 5. The filter unit of claim 4, wherein the housing includes a first end having openings
2 communicating with the plurality of first passages and a second end having openings
3 communicating with the second passages.

1 6. The filter unit of claim 5, wherein the housing includes an opening at one of the first and
2 second ends communicating with the third passage, and an opening at one of the first and
3 second ends communicating with the fourth passage.

1 7. The filter unit of claim 1, wherein each particulate filter includes an outer porous shell, a
2 filter section within the outer porous shell, and an inner porous shell within the filter
3 section.

1 8. The filter unit of claim 1, wherein the housing includes a first end having openings
2 communicating with the plurality of first passages and a second end having openings
3 communicating with the second passages.

1 9. A filter system for removing soot from exhaust of an exhaust producing device, the filter
2 system comprising one or more attachable units for varying the size of the filter system,
3 the system comprising:
4 a particulate filter unit; and
5 one or more combination particulate and nitrogen oxide filter units.

1 10. The filter system of claim 9, wherein the particulate filter unit includes:
2 a particulate filter unit housing;
3 a plurality of concentrically arranged particulate filters within the particulate filter
4 unit housing;
5 a plurality of first passages passing adjacent at least one particulate filter and
6 opened to a first end of the particulate filter unit housing;
7 a plurality of second passages passing adjacent at least one particulate filter and
8 opened to a second end of the particulate filter unit housing;
9 whereby exhaust passes through a particulate filter as the exhaust moves from the
10 first passages to the second passages.

1 11. The filter system of claim 10, wherein the particulate filter is made of a material chosen
2 from the group comprising: ceramic fiber paper, ceramic cloth and ceramic woven fiber.

1 12. The filter system of claim 11, wherein the material is coated with a pre-ceramic polymer
2 chosen from the group comprising: silicon carbide, oxycarbide, aluminosilicate and
3 alumina.

1 13. The filter system of claim 9, wherein each combination filter unit includes:
2 a housing;
3 a particulate filter section positioned within the housing; and
4 a nitrogen oxide filter section having a gas-impervious inner cylinder spaced
5 within the particulate filter section and a nitrogen-oxide removing catalyst positioned
6 within the inner cylinder.

1 14. The filter system of claim 13, wherein, in each combination filter unit, exhaust gases pass
2 radially through the particulate filter section and longitudinally through the nitrogen
3 oxide filter section.

1 15. The filter system of claim 13, wherein the gas impervious cylinder has open ends and is
2 spaced from an inner portion of the particulate filter section.

1 16. The filter system of claim 13, wherein the nitrogen oxide filter section is shorter in length
2 than the particulate filter section.

1 17. The filter system of claim 13, wherein each combination filter unit further comprises:
2 a porous cylinder for supporting an inner portion of the particulate filter section;
3 and
4 a first end cap for spacing the nitrogen oxide filter section concentrically within
5 the particulate filter section.

1 18. The filter system of claim 13, wherein each combination filter unit further comprises a
2 second end cap for spacing the nitrogen oxide filter section concentrically within the
3 particulate filter section.

- 1 19. The filter system of claim 13, wherein the gas impervious cylinder includes a vent port
2 for mating with an adjacent unit.
- 3
20. The filter system of claim 13, wherein the particulate filter section is spaced from an
inner surface of the second stage unit housing.
- 1 21. The filter system of claim 13, wherein the particular filter section is made of a material
2 chosen from the group comprising: ceramic fiber paper, ceramic cloth and ceramic
3 woven fiber.

1 22. The filter system of claim 21, wherein the particulate filter section includes one of a set
2 of radially oriented plates of the material and a set of radially oriented pleats of the
3 material.

1 23. The filter system of claim 21, wherein the material is coated with a pre-ceramic polymer
2 chosen from the group comprising: silicon carbide, oxycarbide, aluminosilicate and
3 alumina.

1 24. A filter system for removing soot from exhaust of an exhaust producing device, the filter
2 system comprising one or more attachable units for varying the size of the filter system,
3 the system comprising:
4 a first stage unit housing;
5 a plurality of concentrically arranged particulate filters within the first
6 stage unit housing;
7 a plurality of first passages passing adjacent at least one particulate filter
8 and opened to a first end of the first unit stage housing;
9 a plurality of second passages passing adjacent at least one particulate
10 filter and opened to a second end of the first unit stage housing;
11 whereby exhaust passes through a particulate filter as the exhaust moves
12 from the first passages to the second passages; and
13 one or more second stage units, each second stage unit including:
14 a second stage unit housing;
15 a particulate filter section positioned within the second stage unit housing;
16 and
17 a nitrogen oxide filter section having a gas-impervious inner cylinder
18 spaced within the particulate filter section and a nitrogen-oxide removing catalyst
19 positioned within the inner cylinder.

1 25. The filter system of claim 24, wherein the first and second stage housings each include:
2 an outer metal shell; and
3 a coupling for sequentially attaching a unit to an adjacent unit.

1 26. A filter unit for an exhaust removing filter system having one or more attachable units for

2 varying the size of the filter system, the filter unit comprising:

3 a housing;

4 a plurality of concentrically arranged particulate filters within the housing;

5 a set of intake openings in a first end of the housing,

6 each intake opening communicating with a passage extending adjacent an intake

7 side of at least one particulate filter;

8 a set of output openings in a second end of the housing,

9 each output opening communicating with a passage extending adjacent an output

10 side of at least one particulate filter; and

11 wherein exhaust enters the intake openings, passes through a respective

12 particulate filter and exits through the output openings.

1 27. A filter system for removing soot from exhaust of an exhaust producing device, the filter
2 system comprising one or more attachable units for varying the size of the filter system,
3 each unit including:

4 means for housing filter components;
5 means for filtering particulates positioned within the means for housing; and
6 means for filtering particulates and nitrogen oxide.

1 28. The filter system of claim 27, further comprising means for regenerating the filter
2 system.

1 29. A filter system for removing soot from exhaust of an exhaust producing device, the filter
2 system comprising one or more attachable units for varying the size of the filter system,
3 the system comprising:
4 a particulate filter unit including
5 a particulate filter unit housing;
6 a plurality of concentrically arranged particulate filters within the
7 particulate filter unit housing;
8 a plurality of first passages passing adjacent at least one particulate filter
9 and opened to a first end of the first unit stage housing;
10 a plurality of second passages passing adjacent at least one particulate
11 filter and opened to a second end of the first unit stage housing;
12 whereby exhaust passes through a particulate filter as the exhaust moves
13 from the first passages to the second passages; and
14 one or more combination filter units each including:
15 a combination filter unit housing having an outer shell and a coupling
16 adapted to attach a unit to an adjacent unit;
17 a particulate filter section positioned within the combination filter unit
18 housing;
19 a porous cylinder for supporting an inner portion of the particulate filter
20 section;
21 a gas-impermeable inner cylinder spaced within the porous cylinder; and
22 a nitrogen-oxide removing catalyst positioned within the inner cylinder,

23 wherein exhaust gases pass radially through the particulate filter section and
24 longitudinally through the nitrogen oxide filter.

1 30. The filter system of claim 29, wherein the plurality of particulate filters of the particulate
2 filter unit and the particulate filter section of each combination filter unit are coated with
3 a pre-ceramic polymer chosen from the group comprising: silicon carbide, oxycarbide,
4 aluminosilicate and alumina.